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SEP 26 2002

TC 1700

PATENT

Attorney Docket No. 202531/PALL

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of:

PELZ et al.

Application No. 09/402,721

Art Unit: 1761

Filed: December 28, 1999

Examiner: C. Sherrer

For: METHOD FOR PRODUCING BEER

**PENDING CLAIMS AFTER AMENDMENTS  
MADE IN RESPONSE TO OFFICE ACTION DATED JUNE 25, 2002**

1. A method for producing beer comprising:
  - (a) filtering beer through a porous membrane until such time that the porous membrane is in need of cleaning,
  - (b) contacting the porous membrane with an enzyme selected from the group consisting of cellulases, amylases, and combinations thereof in the absence of a protease or a glucanase to clean the porous membrane, and
  - (c) then reusing the porous membrane to continue filtering beer.
2. The method of claim 1, wherein the porous membrane is not contacted with an enzyme other than the cellulase or the amylase.
3. The method of claim 1, wherein the porous membrane is contacted with the cellulase.
4. A method for producing beer comprising:
  - (a) filtering beer through a porous membrane until such time that said porous membrane is in need of cleaning,
  - (b) contacting the porous membrane with a cellulase having a crystalline:soluble cellulase activity ratio at 60 minutes of at least about 0.1 to clean the porous membrane, and
  - (c) then reusing the porous membrane to continue filtering beer.

5. The method of claim 4, wherein the porous membrane is contacted with the cellulase and is not contacted with any other enzyme.

7. (Amended) The method of claim 4, wherein the cellulase has a crystalline:soluble cellulose activity ratio at 60 minutes of at least about 0.3.

8. The method of claim 7, wherein the cellulase has a crystalline:soluble cellulose activity ratio at 60 minutes of at least about 0.4.

9. The method of claim 8, wherein the cellulase has a crystalline:soluble cellulose activity ratio at 60 minutes of at least about 0.5.

10. The method of claim 9, wherein the cellulase has a crystalline:soluble cellulose activity ratio at 60 minutes of at least about 1.

11. The method of claim 10, wherein the cellulase has a crystalline:soluble cellulose activity ratio at 60 minutes of at least about 1.2.

12. The method of claim 4, wherein the cellulase is derived from *Trichoderma*.

13. The method of claim 12, wherein the *Trichoderma* is *Trichoderma reesei* or *Trichoderma longibrachiatum*.

14. The method of claim 4, wherein the cellulase is derived from *Thermomonospora*.

15. The method of claim 14, wherein the *Thermomonospora* is *Thermomonospora fusca*.

16. The method of claim 4, wherein the porous membrane is contacted with an amylase.

17. The method of claim 16, wherein the amylase is selected from the group consisting of  $\alpha$ -amylase,  $\beta$ -amylase, and the combination thereof.

18. The method of claim 4, wherein the method further comprises contacting the porous membrane with an aqueous base prior to reusing the porous membrane.
20. The method of claim 18, wherein the aqueous base is an aqueous solution of NaOH and/or KOH.
21. The method of claim 18, wherein the base is present in a concentration of 0.1-1 N in the aqueous base.
22. The method of claim 18, wherein the porous membrane is contacted with the aqueous base at a temperature of 40-90 °C.
24. The method of claim 4, wherein the porous membrane is contacted with  $\alpha$ -amylase at a temperature of 60-75 °C and a pH of 4.6-5.8.
25. The method of claim 4, wherein the porous membrane is contacted with  $\beta$ -amylase at a temperature of 40-60 °C and a pH of 4.6-5.8.
26. The method of claim 4, wherein the porous membrane is cleaned until the zeta potential of the porous membrane ceases to change.
27. The method of claim 4, wherein the time that the porous membrane is in need of cleaning is determined by the pressure drop across the porous membrane.
28. The method of claim 4, wherein the method further comprises determining the time that the porous membrane is in need of cleaning by determining the streaming potential or zeta potential of the porous membrane.

29. A method for producing beer comprising:
- (a) filtering beer through a porous membrane that progressively clogs during filtration,
  - (b) monitoring the streaming potential or zeta potential of the porous membrane as a measure of the extent of clogging of the porous membrane,
  - (c) halting filtration of the beer through the porous membrane before the porous membrane becomes fully clogged as determined by the streaming potential or zeta potential of the porous membrane,
  - (d) cleaning the porous membrane, and
  - (e) then reusing the porous membrane to continue filtering beer.
30. The method of claim 28, wherein the filtration is halted when the streaming potential or zeta potential of the porous membrane is reduced to 20% of its original value for the unused porous membrane.
31. The method of claim 4, wherein the porous membrane is a polyamide porous membrane.
32. The method of claim 31, wherein the filtration is halted when the zeta potential of the porous membrane exceeds -5 mV as measured at pH 4.2.
33. The method of claim 4, wherein the filtering of the beer is cold-filtering of the beer.
34. A filtration unit for filtering beer comprising a feeder line for the filtration-bound beer, a porous membrane, a run-off line for the filtered beer, and means for monitoring the streaming potential and/or zeta potential of the porous membrane through which beer flows.
35. The filtration unit of claim 34, further comprising a bypass porous membrane through which beer flows, wherein the monitoring means for monitoring the streaming potential and/or zeta potential does so with respect to the bypass porous membrane.
36. The method of claim 29, wherein cleaning the porous membrane comprises contacting the porous membrane with a cellulase having a crystalline:soluble cellulase activity ratio at 60 minutes of at least about 0.1 to clean the porous membrane.

37. The method of claim 4, wherein the porous membrane is a nylon-6, 6 membrane.
38. The method of claim 4, wherein the porous membrane has a pore rating of about 0.02-1  $\mu\text{m}$ .
39. The method of claim 38, wherein the porous membrane has a pore rating of about 0.1-1  $\mu\text{m}$
40. The method of claim 39 wherein the porous membrane has a pore rating of about 0.45  $\mu\text{m}$ .
41. The method of claim 4, wherein the method further comprises pre-filtering the beer before filtering the beer through the porous membrane.
42. The method of claim 41, wherein the beer is pre-filtered through Diatomaceous earth or a combination of Diatomaceous earth and deep-bed filtration.